

What is claimed is:

1. A liquid-crystal lens, comprising:

a hologram liquid-crystal element including a liquid crystal which provides a light beam transmitting therethrough with a phase change so as to have a wavefront of a blaze-hologram shape; and

a segment liquid-crystal element including a first electrode divided correspondingly to the blaze-hologram shape, a second electrode opposed to the first electrode and a liquid crystal for providing the transmitting light beam with a phase change by voltage application to the first and second electrodes, the segment liquid-crystal element being arranged coaxial to the hologram liquid-crystal element.

2. A liquid-crystal lens according to claim 1, wherein the hologram liquid-crystal element has a hologram liquid crystal encapsulated in a blaze-hologram shape and an electrode for changing a magnitude of a phase change provided to the transmitting light beam by voltage application.

3. A liquid-crystal lens according to claim 1, wherein the hologram liquid-crystal element has a segment electrode divided correspondingly to the blaze-hologram shape, an opposing electrode opposed to the segment electrode, and a flat-plate-formed liquid crystal provided between the segment electrode and the opposing electrode, to cause an effect of blaze hologram by voltage application to the segment electrodes and the opposing electrodes.

4. A liquid-crystal lens according to claim 1, wherein

the first electrode comprises a plurality of transparent electrodes.

5. A liquid-crystal lens according to claim 1, wherein the first electrode includes a plurality of transparent electrodes and a low-resistance electrode comprised of a higher conductive material than the plurality of transparent electrodes and formed in an edge of the transparent electrode.

6. A driving method for a liquid-crystal lens having a hologram liquid-crystal element for providing a phase change of a blaze-hologram shape to a transmitting light beam by voltage application thereto, and a segment liquid-crystal element including a first electrode divided correspondingly to the blaze-hologram shape, a second electrode opposed to the first electrode, and a liquid crystal for providing a phase change to the transmitting light beam by voltage application to the first and second electrodes, and arranged coaxial to the hologram liquid-crystal element, the driving method for a liquid-crystal lens comprising a step of:

adjusting the voltage application to the hologram liquid-crystal element and the segment liquid-crystal element such that the light beam after transmitted through the hologram liquid-crystal element and the segment liquid-crystal element has a combined wavefront being continuous.

7. A driving method according to claim 6, further comprising steps of:

determining whether or not a phase difference to be provided to the light beam transmitting through the hologram

liquid-crystal element and the segment liquid-crystal element is equal to or greater than a predetermined value, and

adjusting the voltage application to a segment electrode of the first electrode to change an amount of a phase change  
5 by the segment electrode to a value subtracted a phase amount corresponding to integer times a wavelength of the light beam when the phase difference is determined equal to or greater than the predetermined value in the determining step.

8. A driving apparatus for a liquid-crystal lens,  
10 comprising:

a liquid-crystal lens having a hologram liquid-crystal element for providing a phase change of a blaze-hologram shape to a transmitting light beam by voltage application, and a segment liquid-crystal element including a first electrode  
15 divided correspondingly to the blaze-hologram shape, a second electrode opposed to the first electrode, and a liquid crystal for providing a phase change to the transmitting light beam by voltage application to the first and second electrodes, and arranged coaxial to the hologram liquid-crystal element, and

20 a controller for controlling the voltage application to the hologram liquid-crystal element and the segment liquid-crystal element such that the light beam after transmitted through the hologram liquid-crystal element and the segment liquid-crystal element has a combined wavefront  
25 being continuous.

9. A driving apparatus according to claim 8, further comprising a determining portion for determining whether or

not a phase difference to be provided to the light beam transmitting through the hologram liquid-crystal element and the segment liquid-crystal element is equal to or greater than a predetermined value, wherein

5           the controller adjusts the voltage application to a segment electrode of the first electrode to change an amount of a phase change by the segment electrode to a value subtracted a phase amount corresponding to integer times a wavelength of the light beam when the phase difference is determined equal  
10 to or greater than the predetermined value by the determining portion.